Effects of Public Education by Television on Knowledge of Early Stroke Symptoms Among a Japanese Population Aged 40 to 74 Years
A Controlled Study

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Background and Purpose—An educational campaign by mass media has been associated with great increases in the knowledge about early symptoms of stroke. However, few studies were conducted with a controlled community intervention study.

Methods—To clarify the effects of a 1-year television campaign for the whole population on improvement of knowledge about stroke symptoms in 2 cities, a campaign area and a control area in Japan were selected. Before and after the campaign, 1960 randomly selected residents aged 40 to 74 years answered a telephone survey regarding knowledge of early stroke symptoms. We calculated the percentage and 95% CIs of participants who correctly chose all 5 early symptoms of stroke in each area and in each year.

Results—Before the campaign, 53% of participants (95% CI, 50%–55%) in the campaign area and 46% (95% CI, 44%–49%) in the control area correctly chose 5 early symptoms. After the 1-year television campaign, knowledge was significantly improved only in the campaign area (campaign area, 63%; 95% CI, 60%–66%; control area, 51%; 95% CI, 48%–54%). After sex stratification, only women showed improved knowledge of early symptoms. The audience rate for the campaign television programs was found to be higher in women than in men.

Conclusions—A 1-year stroke educational television campaign effectively improved knowledge about early stroke symptoms among Japanese women aged 40 to 74 years. No impact was found among men in this age group. Future studies should examine the impact of this approach on stroke knowledge among younger individuals and whether there are any behavioral changes that contribute to earlier presentation for treatment. (Stroke. 2012;43:00-00.)

Key Words: acute stroke ■ educational campaigns ■ knowledge ■ prevention ■ symptoms ■ warning signs

Delayed access to medical care in patients with stroke is associated with poor outcome. Knowledge of the early symptoms of stroke and the need to call an ambulance should therefore be widespread. The importance of ensuring timely treatment has grown dramatically since the introduction of thrombolytic treatment with tissue-type plasminogen activator for cerebral infarction.

Various strategies for community education have been examined in previous studies. Some reports have noted that television campaigns show greater efficacy for public education than other media. However, few controlled studies have evaluated the effects of community education by television on knowledge about the early symptoms of stroke. Furthermore, to our knowledge, there is no community education by television for stroke in Asian countries, where mortality due to stroke is high.

The purpose of this study was to verify that television campaign could improve knowledge about early symptoms of stroke.

Methods

Study Setting
A community intervention providing information on early symptoms of stroke was conducted by television. The preintervention survey was performed in April 2009 and the postintervention survey was performed in April 2010. Because mortality of stroke varies between...
western and eastern Japan, 2 cities were selected from adjoining
prefectures located in western Japan: Okayama city in Okayama
prefecture for the campaign area and Kure city in Hiroshima
prefecture for the control area.

A local branch of Japan Broadcasting Corporation (NHK, the
largest noncommercial broadcasting in Japan) produced a series
of television programs for the present study and broadcast them
throughout the 1-year campaign period from April 2009. Okayama
city was located in the broadcasting area of this local branch
(Ookayama broadcasting station of NHK). Residents living in
the control area had few chances to watch these educational contents,
because contents of broadcasting of a local branch of NHK vary by
prefectures, and 2 cities do not have a common border and are
located far from each other (approximately 150 km).

Participants
Sample size was calculated based on previous surveys without
television programs. The number of participants required was
estimated to be 780 people for each area (α=0.05, β=0.8). We
decided to recruit approximately 1000 people from both areas for
each of pre- and postintervention surveys.

Potential participants were randomly selected from the telephone
directory in each area in each survey. A telephone survey was then
continued until 140 complete interviews had been obtained for both
men and women at 70 to 74 years old. A total of 3920 citizens were surveyed to find 980 in the
campaign area and 980 in the control area for each pre- and
postintervention survey. Approximately two thirds of available
contacts were nonrelevant contacts, representing contacts with indi-
viduals <40 years old or ≥75 years old. Because the population was
aged 40 to 74 was 300 389 in the campaign area and 114 670 in the
control area in 2009, the sampling rate was approximately 0.33% and
0.85%, respectively.

Community Education
Because television programs produced by NHK are systematically
distributed, similar television programs are broadcast by all local
branches of NHK. However, sometimes slots are at the discretion of
the local branch, such as 1-minute spots before serial dramas or
15-minute slots for local news before national news programs. The
television campaign in the present study was thus mainly performed
using these time slots.

The major points of the campaign by television programs were as
follows. The first point was to make broadcasting content based on
accurate scientific evidence. The second point was to provide
repeated audiovisual information, that is, 1-minute spots were
broadcast at least twice almost everyday, whereas highlight pro-
grams were broadcast at least once a week. Both types of programs
were continued throughout the study period from April 2009 to
March 2010.

The Okayama broadcasting station for NHK, Kawasaki Medical
School, and the Japan Stroke Association supervised the campaign
programs. The 1-minute spots comprised a total of 10 versions
covering stroke, both of early symptoms and risk factors, prevention,
up-to-date medical treatments, and rehabilitation. Highlight pro-
grams featuring 33 topics were broadcast during the campaign
period.

Main Outcome Measures
Participants were asked to choose which of 10 listed symptoms fit as
early symptoms of stroke. The 10 symptoms listed consisted of 5
early symptoms of stroke1 and 5 incorrect or atypical symptoms
("sudden nasal bleeding," "sudden hot flush," "sudden pain in
the left shoulder," "numbness or palsy of both hands and/or fingers," and
"sudden difficulty breathing").

At the postintervention survey in the campaign area, participants
were also asked whether they had seen any of the television spots and
special programs.

Statistical Analysis
We estimated 95% CIs of population proportions for those who
correctly chose all 4 early symptoms of stroke in surveys according to
F-distribution. Sex-specific analysis was also performed. Participants
who chose all 10 symptoms (n=45) were excluded from these analyses.

Results
Response rates of telephone surveys were 31.6% and 34.7% for
pre- and postintervention surveys in the campaign area and
30.3% and 35.5% in the control area, respectively. In the
postintervention survey in the campaign area, approximately
40% of participants reported “I saw some of the 1-minute
spots about stroke on NHK between April 2009 and March
2010,” whereas 30% reported seeing the highlight programs
(Table 1). These audience rates for both types of programs
were significantly higher for women than for men.

Proportions of participants who correctly chose 5 early
symptoms are shown in Table 2. In all groups, regardless of
area or sex, we observed tendencies toward improvement in
knowledge about early symptoms of stroke; however, 95%
CIs of those proportions demonstrated that only the campaign
area showed a significant improvement in stroke knowledge
(Figure). After sex stratification, only women in the cam-
paign area showed a significant improvement (Figure).

In addition, the participants who watched either program
had better knowledge about early symptoms of stroke (age-
and sex-adjusted ORs and 95% CIs, 1.41 and 1.07–1.86).

Table 1. Exposure to Intervention During the Campaign Period Among Participants in the Campaign Area: Postintervention
Telephone Survey 2010

<table>
<thead>
<tr>
<th>Educational Intervention by Television</th>
<th>Exposure to Intervention, No. (%)</th>
<th>Sex Differential</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall (n = 968)</td>
<td>Men (n = 484)</td>
</tr>
<tr>
<td>1-min spots‡</td>
<td>381 (39.8)</td>
<td>161 (33.3)</td>
</tr>
<tr>
<td>Highlight programs‡</td>
<td>274 (28.3)</td>
<td>108 (22.3)</td>
</tr>
<tr>
<td>Both of 1-min spots‡ and highlight programs‡</td>
<td>207 (21.4)</td>
<td>74 (15.3)</td>
</tr>
<tr>
<td>At least 1 of 1-min spots‡ and highlight programs‡</td>
<td>447 (46.2)</td>
<td>195 (40.3)</td>
</tr>
</tbody>
</table>

*P value for χ² test.
‡One-min spots: approximately 900 times of TV spots about stroke, each airtime was 60 s.
†Highlight programs: a total of 60 times of documentaries and reports about stroke, each airtime was 5–15 min.
**Table 2. Proportion of Participants Who Correctly Chose 5 Early Symptoms of Stroke**

<table>
<thead>
<tr>
<th></th>
<th>Campaign Area</th>
<th>Control Area</th>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2009</td>
<td>2010</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Preintervention</td>
<td>Postintervention</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Preintervention</td>
<td>Postintervention</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td></td>
<td>965</td>
<td>968</td>
</tr>
<tr>
<td>Correct answer about stroke symptoms (%)</td>
<td></td>
<td></td>
<td>971</td>
<td>971</td>
</tr>
<tr>
<td>Sudden numbness or weakness of the face, arm, or leg</td>
<td>868 (89.9)</td>
<td>869 (89.9)</td>
<td>805 (82.9)</td>
<td>812 (83.6)</td>
</tr>
<tr>
<td>Sudden confusion or trouble speaking or understanding others</td>
<td>907 (94.0)</td>
<td>901 (93.1)</td>
<td>895 (92.9)</td>
<td>879 (90.5)</td>
</tr>
<tr>
<td>Sudden trouble seeing with 1 or both eyes</td>
<td>674 (69.8)</td>
<td>764 (78.9)</td>
<td>651 (67.0)</td>
<td>642 (66.1)</td>
</tr>
<tr>
<td>Sudden dizziness, walking difficulties, or loss of balance or coordination</td>
<td>806 (83.5)</td>
<td>815 (84.2)</td>
<td>756 (77.9)</td>
<td>787 (81.1)</td>
</tr>
<tr>
<td>Sudden severe headache with no known cause</td>
<td>810 (83.9)</td>
<td>821 (84.8)</td>
<td>773 (79.6)</td>
<td>812 (83.6)</td>
</tr>
<tr>
<td>No. of selected correct answer about stroke symptoms (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>24 (2.5)</td>
<td>41 (4.2)</td>
<td>34 (3.5)</td>
<td>47 (4.8)</td>
</tr>
<tr>
<td>1</td>
<td>13 (1.3)</td>
<td>14 (1.4)</td>
<td>33 (3.4)</td>
<td>33 (3.4)</td>
</tr>
<tr>
<td>2</td>
<td>43 (4.5)</td>
<td>23 (2.4)</td>
<td>44 (4.5)</td>
<td>35 (3.6)</td>
</tr>
<tr>
<td>3</td>
<td>83 (8.6)</td>
<td>59 (6.1)</td>
<td>129 (13.3)</td>
<td>89 (9.2)</td>
</tr>
<tr>
<td>4</td>
<td>293 (30.4)</td>
<td>222 (22.9)</td>
<td>283 (29.1)</td>
<td>273 (28.1)</td>
</tr>
<tr>
<td>5*</td>
<td>509 (52.7)</td>
<td>609 (62.9)</td>
<td>448 (46.1)</td>
<td>494 (50.9)</td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of participants</td>
<td>478</td>
<td>484</td>
<td>484</td>
<td>486</td>
</tr>
<tr>
<td>Correct answer about stroke symptoms (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sudden numbness or weakness of the face, arm, or leg</td>
<td>422 (88.3)</td>
<td>421 (87.0)</td>
<td>389 (80.4)</td>
<td>388 (79.8)</td>
</tr>
<tr>
<td>Sudden confusion or trouble speaking or understanding others</td>
<td>444 (92.9)</td>
<td>437 (90.3)</td>
<td>437 (90.3)</td>
<td>429 (88.3)</td>
</tr>
<tr>
<td>Sudden trouble seeing with 1 or both eyes</td>
<td>342 (71.5)</td>
<td>365 (75.4)</td>
<td>328 (67.8)</td>
<td>325 (66.9)</td>
</tr>
<tr>
<td>Sudden dizziness, walking difficulties, or loss of balance or coordination</td>
<td>386 (80.8)</td>
<td>386 (79.8)</td>
<td>350 (72.3)</td>
<td>373 (76.7)</td>
</tr>
<tr>
<td>Sudden severe headache with no known cause</td>
<td>399 (83.5)</td>
<td>400 (82.6)</td>
<td>364 (75.2)</td>
<td>399 (82.1)</td>
</tr>
<tr>
<td>No. of selected correct answer about stroke symptoms (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>14 (2.9)</td>
<td>28 (5.8)</td>
<td>23 (4.8)</td>
<td>28 (5.8)</td>
</tr>
<tr>
<td>1</td>
<td>7 (1.5)</td>
<td>12 (2.5)</td>
<td>25 (5.2)</td>
<td>19 (3.9)</td>
</tr>
<tr>
<td>2</td>
<td>23 (4.8)</td>
<td>14 (2.9)</td>
<td>23 (4.8)</td>
<td>24 (4.9)</td>
</tr>
<tr>
<td>3</td>
<td>50 (10.5)</td>
<td>30 (6.2)</td>
<td>65 (13.4)</td>
<td>47 (9.7)</td>
</tr>
<tr>
<td>4</td>
<td>130 (27.2)</td>
<td>121 (25.0)</td>
<td>138 (28.5)</td>
<td>134 (27.6)</td>
</tr>
<tr>
<td>5*</td>
<td>254 (53.1)</td>
<td>279 (57.6)</td>
<td>210 (43.4)</td>
<td>234 (48.1)</td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of participants</td>
<td>487</td>
<td>484</td>
<td>487</td>
<td>485</td>
</tr>
<tr>
<td>Correct answer about stroke symptoms (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sudden numbness or weakness of the face, arm, or leg</td>
<td>446 (91.6)</td>
<td>448 (92.6)</td>
<td>416 (85.4)</td>
<td>424 (87.4)</td>
</tr>
<tr>
<td>Sudden confusion or trouble speaking or understanding others</td>
<td>463 (95.1)</td>
<td>464 (95.9)</td>
<td>458 (94.0)</td>
<td>450 (92.8)</td>
</tr>
<tr>
<td>Sudden trouble seeing with 1 or both eyes</td>
<td>332 (68.2)</td>
<td>399 (82.4)</td>
<td>323 (66.3)</td>
<td>317 (65.4)</td>
</tr>
<tr>
<td>Sudden dizziness, walking difficulties, or loss of balance or coordination</td>
<td>420 (86.2)</td>
<td>429 (88.6)</td>
<td>406 (83.4)</td>
<td>414 (85.4)</td>
</tr>
<tr>
<td>Sudden severe headache with no known cause</td>
<td>411 (84.4)</td>
<td>421 (87.0)</td>
<td>409 (84.0)</td>
<td>413 (85.2)</td>
</tr>
<tr>
<td>No. of selected correct answer about stroke symptoms (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>10 (2.1)</td>
<td>13 (2.7)</td>
<td>11 (2.3)</td>
<td>19 (3.9)</td>
</tr>
<tr>
<td>1</td>
<td>6 (1.2)</td>
<td>2 (0.4)</td>
<td>8 (1.6)</td>
<td>14 (2.9)</td>
</tr>
<tr>
<td>2</td>
<td>20 (4.1)</td>
<td>9 (1.9)</td>
<td>21 (4.3)</td>
<td>11 (2.3)</td>
</tr>
<tr>
<td>3</td>
<td>33 (6.8)</td>
<td>29 (6.0)</td>
<td>64 (13.1)</td>
<td>42 (8.7)</td>
</tr>
<tr>
<td>4</td>
<td>163 (33.5)</td>
<td>101 (20.9)</td>
<td>145 (29.8)</td>
<td>139 (28.7)</td>
</tr>
<tr>
<td>5*</td>
<td>255 (52.4)</td>
<td>330 (68.2)</td>
<td>238 (48.9)</td>
<td>260 (53.6)</td>
</tr>
</tbody>
</table>

*This proportion was defined as “participants who have knowledge about early symptoms of stroke” in the present study.
Discussion

This study is the first study of community education of stroke early symptoms in an Asian country. One advantage of the present study was the evaluation of the efficacy of television programs in the controlled trial with all participants randomly selected from the populations of the 2 areas. Another advantage was the use of a 1-year campaign, in which medically accurate contents were made by the collaboration of not only researchers and medical professionals, but also many staff from the largest noncommercial broadcasting corporation in Japan, that is, with mass media communication experts. As a result, this collaboration might have made the television programs more attractive for the audience, and many subjects reported that they had seen the 1-minute spots and the highlight programs during the campaign. In addition, our programs were repeated many times, which should have increased the likelihood of people seeing them, remembering them, and also remembering how to act if someone experiences early symptoms of stroke.

In previous studies that focused on public education about knowledge of stroke symptoms, the effectiveness of campaigns was assessed according to the ability to name ≥2 early symptoms of stroke without being shown multiple-choice items.6,12 However, patients with stroke are unable to choose their own symptom at the time of onset, so people should be aware of all the typical early symptoms of stroke. Accordingly, the present study assessed improvements in knowledge about early symptoms of stroke based on the proportion of respondents who correctly chose all 5 early symptoms from a list of 10 symptoms.

We did not find significant improvements in knowledge about early symptoms of stroke among men. The improvement only in women may be explained by the greater exposure to television programs associated with the campaign, as suggested by the higher audience rates in women than in men. Furthermore, in previous studies of Western populations, knowledge about early symptoms of stroke was found to be better in women than in men during periods both with and without educational campaigns.12,13 Our results demonstrated not only similar sex differences to these previous studies, but also sex differences in the effects of the television campaign in a controlled trial. These results raise the possibility that men may have less general interest about health information compared with women. Therefore, it may be important to provide men various occasions to watch educational programs; for example, to increase a total number of on-air times, especially around programs that men are likely to watch such as sports, news, and action movies.

There are several limitations in the present study. First, we only evaluated the improvement in knowledge about early symptoms of stroke by broadcasting campaign; therefore, further study is necessary to assess its effectiveness in actual behaviors of patients with stroke; for example, the number of patients with stroke calling an ambulance, time from symptom onset to hospital presentation, how soon bystanders called the emergency center after having noticed early symptoms, and numbers of patients able to undergo therapy with tissue-type plasminogen activator should be evaluated. A previous cross-sectional study indicated that the knowledge about stroke symptoms was not associated with the intent to call 911 for stroke.14 A gap may exist between the improvements in knowledge and actual changes in patient behavior. A second limitation is the lack of information about the costs involved in the campaign. The television programs were
made by NHK Okayama as its own project. Researchers thus did not need to worry about the costs of content production and broadcasting. Third, this study did not include individuals <40 years, who may be a person identifying a stroke onset of his or her family members and accessing the emergency medical services system. In addition, it is also important to distribute information about stroke to children and adolescent by television programs they are watching. They would probably advise their parents even if parents are not too interested about health information. This should be assessed in future studies.

Acknowledgments
We thank Mr Ken Goto and Ms Sachiko Yamada from NHK (Nippon Hōsō Kyōkai; Japan Broadcasting Corporation) for their excellent program production. Approval for this study was obtained from the institutional review board at Shiga University of Medical Science (No. 20-124, 2008).

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Disclosures
None.

References
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The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/early/2011/11/03/STROKEAHA.111.634196